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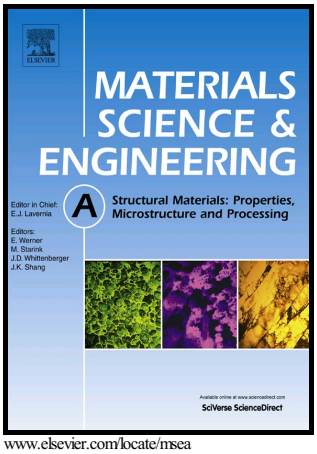

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Tensile Behaviors of Pure Copper with Different Fraction of Nonequilibrium Grain Boundaries

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Abstract

Pure copper with different fraction of nonequilibrium grain boundaries were achieved by friction stir processing (FSP) under air, water and liquid nitrogen cooling conditions. Tensile behaviors at room temperature exhibited significant difference for above three cases involving different fraction of nonequilibrium grain boundaries. The case with nitrogen cooling showed better combination of strength and elongation for the largest fraction of high energy nonequilibrium boundaries, which contribute to emit dislocations from grain boundaries and suppress grain boundary sliding. Fully relaxed grain boundaries in air cooling samples can suppress the grain boundary sliding and dislocation emission causing high stress and very low elongation. However, appropriate relaxed grain boundaries in the water cooling samples will promote grain boundary sliding and the increase of elongation. The grain coarsening during tensile deformation was observed in those samples with nonequilibrium grain